UNITED STATES FOREST SERVICE

REGIONAL MONITORING PLAN FOR NEOTROPICAL MIGRATORY BIRDS

REGION 5
CALIFORNIA

January 1994

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I. BACKGROUND

A. National Neotropical Migratory Bird Program

Recent analyses of regional bird censuses (Robbins et al. 1989a, b) indicate that population reductions of many neotropical migratory birds are occurring across North America (Wilcove and Whitcomb 1983, Terborgh 1989, James et al. 1992, Withan and Hunter 1992). However, trends vary among species and geographic ares, indicating that more comprehensive and detailed monitoring is needed to better understand the problem(s) (Finch 1991). Because neotropical migrants comprise up to 70% of the breeding birds in forested, woodland, and grassland habitats across the nation, their decline poses a serious threat to the diversity of avifaunas in North America (Terborgh 1989, Askins et al. 1990). Clearly, a comprehensive and cooperative national and international program is needed to monitor and conserve populations of migrant avian species.

In May 1990, the National Fish and Wildlife Foundation launched 'Partners in Flight - Aves de las Americas, the Neotropical Migratory Bird Conservation Program', which is a domestic and international initiative for the conservation of neotropical migratory birds. The Partners in Flight Program is designed to focus monitoring, research, and habitat management at national and international scales. The USDA Forest Service administers a large proportion of forested and grassland habitats in the United States and is an active member of the Partners in Flight Program. Consequently, the USDA Forest Service has an important role in the conservation of neotropical migratory bird populations.

B. Contributions to Other Regional Goals and Priorities

The monitoring scheme outlined in this document was motivated by concerns for NTMBs, but it will serve to monitor resident bird species, as well as neotropical migratory bird species. As a result, the NTMB program in California has the potential to provide the vehicle by which we can obtain valuable information on the status of a variety of bird species and bird communities on NFS lands. Bird communities provide a valuable barometer to the condition of ecosystems (Dickson et al. 1979, Morrison 1986). Monitoring NTMBs will contribute to our understanding of ecosystem structure and function, and thereby further our understanding of the role of NTMBs in ecosystems.

Monitoring species is central to evaluating the success of Forest Plan implementation. NFMA Reg. 36 CFR 219.12(k) requires that Forest Plans include 3 types of monitoring: (1) implementation monitoring to determine if a plan or project has been implemented as prescribed; (2) effectiveness monitoring to determine if a particular action produced the expected results; and (3) validation

monitoring to determine if a model or a set of assumptions hold true in a particular area. The monitoring framework described here for birds will contribute greatly to validation monitoring for land management planning by improving our understanding of ecosystem structure, function, and interdependence.

NFMA directs the Forest Service to identify Forest Management Indicator Species (MIS) and associated monitoring plans in their land management plans. The regulations state that, "Population trends of the management indicator species will be monitored and relationships to habitat changes determined." (36 CFR 219.19 a6). MIS are intended to reflect the effects of management activities on all animal species and communities. However, the concept of using one or a few species to reflect a larger assemblage of species has been investigated and questioned by many researchers, and most investigations do not lend credence to the concept (Szaro and Balda 1982, Verner 1983, Mannan et al. 1984, Verner 1984, Block et al. 1986, Morrison 1986, Szaro 1986, Thomas and Verner 1986, Verner 1986, Block et al. 1987a, Landres et al. 1988). The monitoring framework described here monitors most bird species, potentially fulfilling the monitoring needs for all avian MIS and greatly strengthening the ability of the Region to estimate the status of habitat quality for birds.

Although a majority of Region 5 Forest Plans focused MIS monitoring on individual species, a few of which are neotropical migrants, eight Forests did list bird assemblages as MIS. Bird assemblages listed in Forest Plans include those generally associated with a particular habitat type such as riparian, conifer, oak woodland, pinyon/juniper and chaparral. Individual MIS, such as the least Bell's vireo, bald eagle, American peregrine falcon and willow flycatcher, represent species that are federally listed as threatened, endangered or Forest Service sensitive.

Monitoring bird assemblages as MIS will greatly strengthen our ability to estimate population trends as well as the status of habitat quality for all land birds including NTMBs. Region 5 administers a significant portion of the undeveloped lands and some of the least fragmented habitats within the State of California. Management of NFS lands will have a profound affect on the quality and quantity of breeding habitat available to NTMBs and resident bird species within the State. Monitoring populations and habitats of resident bird species and NTMBs will provide important information on the sustainability of natural ecological systems, including the maintenance and enhancement of biological diversity. Biological diversity and sustaining ecosystems are the central tenets of ecosystem management nationally and in Region 5. The NTMB program, and specifically full implementation of the monitoring program, would contribute significantly to achieving ecosystem management objectives in this Region.

The NTMB program within the Region has the potential to provide the vehicle by which we can obtain valuable information on the status of a variety of bird species and bird communities on NFS lands. From this perspective, a monitoring plan for NTMBs contributes to compliance with the National Forest Management Act, Regional requirements for the implementation of land management plans, and the Region's Ecosystem Management strategy.

C. Regional Activities in the NTMB Program

Region 5 of the Forest Service manages 20 million (25%) of California"s 85 million acres of forest and rangeland. The 18 National Forests within the Region provide essential habitat for approximately 139 breeding, wintering, and/or migrating NTMBs in addition to numerous resident land bird populations.

In 1992 and 1993, the Pacific Southwest Region of the Forest Service implemented a pilot monitoring effort to: 1) assess monitoring methods endorsed by the National Monitoring Steering Committee of the NTMB Program; 2) form partnerships; and 3) provide opportunities for training and education. A total of eight pilot projects were initiated based on their ability to best meet those objectives listed above and were implemented cooperatively between the Forest Service, Universities and non-governmental organizations. The goal of the pilot monitoring program was to help the Region develop a monitoring scheme for NTMBs. Much of what was learned from the pilot monitoring effort has been incorporated into this document.

In addition, the Region undertook an analysis of NTMBs in 1993 to assess the relative risks of population decline among species and identify conservation priorities within California (Manley and Davidson 1993). The species risk analysis will be used to help the Region identify objectives and priorities, and more effectively allocate resources for monitoring and inventory, habitat management, and information needs.

During 1994, the Region will conduct an analysis of habitat types on Forest Service lands and within the State to determine those that are most at risk (Davidson and Manley in prep). This information, in combination with the species risk analysis, will help further refine objectives and priorities. Habitat types used in the analysis will be those used in the Wildlife Habitat Relationships program (Mayer and Laudenslayer 1991).

D. Monitoring Zones

This monitoring plan provides guidance for assessment, monitoring and management of the majority of bird species in the State and their associated habitats on National Forest System Lands in California. California has a diversity of habitat conditions created by topographic and maritime influences which, in

conjuction with the proximity to tropical and oceanic environments, serve to support a diverse avifauna.

The concept of bioregions with California has been useful in identifying distinct ecological systems that have common properties in terms of management pressures and information needs. The State has been working with generalized bioregional boundaries for planning and discusssion purposes that are a reflection of vegetation, soils, climate, and political boundaries (cite???). We have chosen to use a bioregional scheme proposed by Welsh (in prep) in his paper, "The Bioregions of California: An Ecological and Evolutionary Perspective and a Proposal" that recognizes 13 distinct bioregions. Welsh's descriptions serve to provide an ecological backdrop for the monitoring needs and objectives identified later in the plan.

Since many bioregions do not encompass Forest Service lands, and since the focus of this monitoring plan is on National Forest System lands, we divided the Region into three zones to more effectively focus monitoring efforts at the appropriate scale. The zone boundaries (i.e., National Forests in each zone) were based primarily on biogeographic considerations, as reflected in the bioregional descriptions.

Three zones were identified: South, Sierra Nevada, and Klamath zones (Figure 1 [to be made]). Each zone is described below.

1. The South zone. National Forests within this zone are the Angeles, San Bernardino, Los Padres, and the Cleveland. This zone encompasses portions of the Central Coast, South Coast, Mohave Desert, Colorado Desert Transverse and Peninsular bioregions, as delineated and described in Welsh (in prep).

2. The Sierra Nevada zone. National Forests within this zone include the Sequoia, Inyo, Sierra, Stanislaus, Lake Tahoe Management Basin Unit, Tahoe, Plumas, Lassen, Eldorado and the Modoc. This zone encompasses the Sierra-Cascade bioregion in addition to portions of the Modoc-Inyo, Sacramento Valley, San Joaquin Valley, and Modoc Plateau bioregions, as they are delineated and described in Welsh (in prep).

3. The Klamath zone. National Forests within this zone include the Shasta-Trinity, Mendocino, Six Rivers, and Klamath. This zone encompasses the entire Klamath bioregion, in addition to portions of the Sacramento Valley, North Coast, and Sierra-Cascade bioregions, as delineated and described in Welsh (in prep).

Monitoring objectives were developed for the Region as a whole and for each zone. Zone specific objectives pertain to unique or specific monitoring needs within each zone. Although the Region will concentrate its efforts on National Forest lands, there is a critical need to coordinate all NTMB activities on a state-wide basis to help insure that goals and objectives of the Partners in Flight Program are achieved. The delination of zones and development of zone specific objectives will facilitate coordinating inventory and monitoring activities across all land ownerships within the State.

II. BROAD GOALS AND OBJECTIVES

A. Inventory and Monitoring Goals

National monitoring standards (Manley et al. 1993) list four primary goals for monitoring NTMBs:

1) to build an understanding of the influence of habitat changes resulting from Forest Service management activities on NTMBs;

2) provide insights into the temporal dynamics and trends of local and regional populations of selected NTMB species;

3) provide some clues as to the causes of trends; and

4) contribute to national and international Partners in Flight Monitoring efforts.

Regional goals for monitoring NTMBs embody both National and Region specific goals:

1) establish a long-term monitoring program for birds, NTMBs in particular, that provides information on population dynamics across habitats, geographic locations, and seasons;

2) design and implement a monitoring program that can be provide information on the effect of specific management schemes on NTMBs;

3) collect and contribute to population trend data sets at local and broad scales (e.g., the western U.S. and North America) such that data are available and useful at a variety of scales, including the local scale;

4) contribute to state-wide monitoring efforts and contribute all types of information (and perhaps expertise) to state-wide or multi-state analyses of population trends and their potential causal factors;

5) highlight information needs that can be fulfilled only by research, such as species life history studies and some questions regarding the effects of management on species and habitats;

6) provide information on habitat trends;

7) identify needed conservation activities and their priorities in regard to species and habitats;

8) take full advantage of existing monitoring activities in meeting the goals and objectives of this NTMB monitoring plan;

9) provide training opportunities for biologists in the Region, and provide opportunities for other interested Regional employees to become exposed to bird monitoring;

10) strive to make all data collection efforts high quality in terms of consistency, accuracy, and precision;

11) apply the information gathered toward conservation of NTMBs in the most effective ways possible.

Prioritizing various types of data collection efforts in regards to species, habitats, geographic areas and how current monitoring efforts contribute to the goals stated here will be discussed in the Methods and Experimental Design section.

B. Inventory and Monitoring Objectives

Broad objectives for inventory and monitoring for the Region as a whole are described below.

Data:

1. Describe trends in the distribution and abundance within seasons region-wide. This objective achieves the goal of accomplishing region-wide monitoring and contributing to national and multi-region data sets.

2. Describe trends in the distribution and abundance within seasons by zone. This objective achieves the goal of better understanding how management schemes or other environmental changes unique to zones are affecting populations.

3. Describe trends in relative abundance within seasons by habitat. This objective accomplishes the goal of obtaining habitat specific trends.

4. Describe changes in relative abundance, productivity, and survivorship in response to management.

5. Describe trends in relative productivity and survivorship within seasons region-wide.

6. Describe trends in relative productivity and survivorship within seasons by habitat.

Implementation:

7. Design and coordinate data collection such that the Region maximizes its ability to contribute to state-wide data needs in an efficient manner.

8. Work with adjacent land owners to initiate or increase monitoring and different land management techniques where the management on non-Forest Service lands affects the success of maintaining populations on FS lands.

9. To the extent feasible, design and implement inventory and monitoring to contribute to Forest Plan monitoring goals and objectives.

10. Take advantage of RNAs and other natural areas as controls for monitoring (e.g., blue oak woodland RNA on Sierra NF), and take advantage.

11. Take advantage of existing or historic monitoring efforts occurring for wildlife (e.g., historic data available for species or habitats of specific interest or particularly valuable long-term data - example on Troy meadow on Sequoia NF have historic occurrence data on Willow Flycatcher) and other resources (e.g., fish, timber, etc).

12. Provide data that is as useful at many different scales, so that all levels of the organization have useful information. This creates autonomy in data collections and analysis, and spreads the responsibility for data collection and analysis among levels in the organization.

13. Develop standardized habitat measurement techniques that biologists can learn and implement. In addition, help improve the quality of broad scale vegetation information as much as possible.

14. Identify high value habitats within the Region and their locations.

15. Be as efficient as possible with available funding, such that as much high quality and needed information is gathered as possible.

16. Analyze the information gathered to develop conservation strategies and identify important areas for conservation within the State on National Forest System lands.

17. Work as closely as possible with research in all aspects of monitoring and conservation.

18. Integrate monitoring and inventory activities with ecological unit inventory as much as possible. This will required assessing which data needs can be met given the experimental design set for the ecological unit inventory.

C. Information and Education Objectives

1. Provide training on biology, ecology, monitoring skills, experimental design, data analysis and manipulation techniques to wildlife biologists to enhance the Region's ability to effectively and efficiently implement monitoring activities.

2. Provide opportunities for non-wildlife biologists to become familiar with the intent and specific activities associated with bird monitoring.

3. Improve access to information on NTMBs, including internal and external information sources (i.e., how to set up BBS routes, available information sources, sources of expertise).

III. SPECIFIC MONITORING OBJECTIVES AND HYPOTHESES

A hierarchical monitoring framework is used to define priorities for various information needs. The hierarchical structure is intended to engage each National Forest to participate in at least one, and hopefully multiple, levels of the framework. The framework allows for variation in the availability of funds and personnel among units and over time. The options range from extensive surveys of population trends requiring a minimum investment of time and funding to intensive monitoring of population demographics. The hierarchical framework defines monitoring options that build on one another, and they are presented in a rough order of priority - ideally some level of effort would be expended at all three levels of the hierarchy within some geographic area (e.g., a zone or perhaps a Region). The framework consists of three levels of monitoring:

1) level 1 entails monitoring population trends;
2) level 2 evaluates habitat relationships or management impacts;
3) level 3 monitors species' demographics and associated environmental factors.

Level 1 Monitoring

Level 1 monitoring is the most basic of monitoring efforts. Level 1 monitoring includes two distinct efforts: (1) cooperating with USFWS to ensure that states, regions, and (possibly) physiographic provinces each have enough BBS routes surveyed annually to characterize population trends at each scale; and (2) monitoring population trends of NTMBs at a Forest or Regional level via off-road and roadside point counts. Level 1 monitoring provides population trend data for a Forest with a minimum amount of effort and funding, but it will not yield information on interpretation of trends, since sampling is not stratified by environmental parameters.

Level 2 Monitoring

Level 2 monitoring is aimed at gathering information on habitat specific population trends, habitat relationships, and landscape effects on populations. Level 2 monitoring requires additional time and effort over and above level 1 monitoring. Individual treatments need to be adequately sampled and replicated across a Region or a Forest. Standards and guidelines for conducting level 2 monitoring are outlined.

Level 3 Monitoring

Level 3 monitoring obtains information on species demographics. Monitoring the relative abundance of species over time is typically inadequate to address cause and effect relationships of management activities or habitat quality. Demographic data will provide information needed to assess population viability and for interpreting population trends. Two generalized procedures are currently being evaluated for their ability to yield demographic data: constant-effort mist-net procedures and nest search and monitoring procedures. Both approaches have inherent advantages and limitations that are discussed and should be considered before use.

Under each level of monitoring, specific objectives are outlined and associated objectives are described for the Region as a whole or within each zone. Objectives are organized by high, moderate and low priority. Within each level of priority, objectives are

categorized by the geographic area (National, Regional, Zone) and labeled as to whether they are considered level 1, 2, or 3 monitoring.

A. High Priority Monitoring Objectives

High priority objectives include: 1) level 2 and 3 monitoring in high value habitats by zone, potentially focusing on species of concern or interest; 2) level 3 monitoring of management effects in high value habitats; and 3) level 2 monitoring of population trends across "typical" habitats by zone. High value habitats can be identified as those habitats associated with NTMBs (see Manley and Davidson 1993), in combination with habitats at risk (Davidson in prep) and habitats of known importance within a zone based on local information. Monitoring data on demographics will generally be focused on a subset of species because of time and money constraints. The subset of species needs to be carefully chosen to meet some monitoring question and the rationale documented in the individual monitoring project plans.

1. Regionwide

a) Improve information on habitat associations by zone for high value habitats and or species of concern, particularly descriptions of the bird species composition and abundance associated with different age classes of specific vegetation types. Included here is obtaining a better understanding of the importance of ecotonal areas (e.g., in Sierra Nevada, Red fir/montane chaparral or oak woodland/chaparral/mixed conifer), old growth seral stages in maintaining populations, and the relative importance of high value habitats that occur in multiple zones (e.g., if aspen stands occur in both the Sierra Nevada and Klamath zones, but occur in limited areas in Klamath, do they have even greater value in the Klamath area because they are limited). Species of concern include species with high Calrank values and species with a large proportion of their range in California for which we have limited habitat relationships information. These data would be valuable for understanding management effects. LEVEL 2/3.

[Note: Species with limited information regarding habitat associations and distributions in multiple zones (as noted in the species notes) include eastern kingbird, american kestrel, savannah sparrow (2 races listed), Scott's oriole (South zone), brewer's sparrow (sagebrush habitat associate), vesper sparrow, swainson's thrush, chipping sparrow, allen's hummingbird (Klamath and South), varied thrush (Klamath

all year, forest interior species), cedar waxwing (Klamath all year, Six Rivers primarily, should get zone specific trends for Klamath), lark sparrow (north part of Sierra zone, provides breeding and winter habitat), rufous hummingbird (Klamath zone is southern extent of its breeding range), lawrence's goldfinch (large proportion of range in California and needs better trend data), and merlin.]

Ho: The frequency of occurrence and abundance of bird species does not vary between age classes within or between vegetation types.

Ho: The distribution and abundance of bird species that whose breeding or wintering range occurs primarily in California does not change from year to year within seasons.

b) Evaluate the value of continuing existing monitoring efforts. LEVEL 2/3.

Ho: The existing monitoring effort does not contribute meeting any of the objectives established for level 2 monitoring.

c) Determine the effect of grazing on WIFL and other NTMB meadow obligates. Ideally this would be determined by comparing treatments and controls before and after grazing. [Note: Could be accomplished by coordinating grazing permits.] LEVEL 2/3.

Ho: Grazing in meadow habitats does not affect the occurrence, abundance, productivity, and/or survivorship of neotropical migratory bird species [Note: This hypothesis could be expanded to investigate various grazing systems.]

d) Improve our understanding of how different management scenarios affect micro-habitat characteristics (such as snags, logs, water needs, cool or moist environments; their quantity and quality) and their influence on the occurrence, abundance, productivity, and/or survivorship of bird species. Focus on high value habitats. Management scenarios of particular interest are salvage sales, individual tree removals, burning regimes in forest and shrub habitats, and grazing in wet areas. LEVEL 3.

Ho: The management action, when it has a given effect on microhabitat (determined through direct measures) does not affect the occurrence, abundance,

productivity, and/or survivorship of bird species. [Note: This could be expanded to investigate a variety of management intensities, where the microhabitat is affected to varying degrees. Need to establish a control if investigating just one type of management activity at a set level of intensity.]

e) Investigate how the use of herbicides affects the occurrence, abundance, productivity and/or survivorship of bird species in high value habitats. The status of birds before and after an application of herbicides could be accomplished by taking advantage of the planned use of herbicides. Herbicides are of special interest because the majority of NTMB species are insectivorous. LEVEL 2/3.

Ho: The application of herbicides does not affect the occurrence, abundance, productivity and/or survivorship of bird species. [Note: Need to characterize changes in habitat conditions and be mindful that site fidelity can mask habitat effects for one or more years after the habitat has been affected.]

f) Investigate the effects of prescribed fire on habitat use by bird species within high value habitats. Particularly pertinent is the direct and indirect effects of large burns on site tenacity and reproductive success. Investigating the effect of large burns could be accomplished by taking advantage of monitoring opportunities after fires occur. Monitoring before and after large control burns could also yield information on the direct effect of burning on breeding birds. LEVEL 2/3.

Ho: Prescribed fire does not affect the presence, abundance, productivity and/or survivorship of bird species. [Note: Fire effects on habitat can vary in many respects. The effects should be isolated so their individual effects can be understood.]

2. Each Zone

a) Determine habitat specific population trends and use patterns (occurrence, abundance, productivity, survivorship) within at least the high value habitats within each zone. LEVEL 2/3.

Ho: Population trends and use patterns within a particular habitat do not change over time for associated bird species.

South Zone - oak woodlands, riparian, mountain meadows, and coastal sage scrub. [Note: Oak woodlands and coastal sage scrub occur primarily on private lands and are estimated to be highly impacted on private lands by grazing and development. Riparian and mountain meadows are estimated to be highly impacted on Forest Service lands.]

Sierra Nevada Zone - aspen, willow/alder habitat complexes, oak woodlands, riparian, and mountain meadows.

Klamath Zone - coastal redwood forests, klamath mixed conifer forests, Douglas-fir tanoak forests, riparian habitats, Port Orford cedar inclusions, oak woodlands, aspen groves, mountain meadows, large areas of serpentine soils and associated unique vegetation (e.g., Jeffrey pine grasslands).

b) Determine the effects (and effectiveness?) of riparian habitat management guidelines being implemented in each zone on NTMB riparian associates. LEVEL 3.

Ho: Riparian areas managed under given guidelines do not differ from areas managed under different guidelines relative to the occurrence, abundance, productivity, and/or survivorship of NTMB species. [Note: Management activities would need to be quantifiable, duplicated (suggest at least 3 areas treated similarly with all other environmental factors held constant or varying randomly), and compared relative to other management activities or some control. This could be accomplished with before and after treatment measurements, or comparing a range of existing conditions.]

c) Evaluate the results of monitoring efforts to date. In every zone, the pilot monitoring efforts need to be evaluated and apply relevant lessons to this monitoring plan. Other zone specific efforts need to be evaluated. LEVEL 2/3.

South zone - results of the riparian monitoring project conducted over the past 5 years to determine: 1) how the results can be used to better design and implement monitoring in this and other zones for riparian habitats; and 2) if continuing it would contribute to zone or region-wide monitoring objectives. LEVEL 2/3.

Ho: The riparian monitoring protocol conducted within riparian habitats over the past 5 years does not contribute to monitoring objectives at a regional or zone level.

South zone - evaluate the design and protocols of the chaparral monitoring effort on the Angeles NF.

Ho: The chaparral monitoring effort on the Angeles NF does not contribute to the monitoring objectives of the zone or the Region.

d) Determine if the distribution and abundance of individual bird species varies within each zone between years within a season by habitat. The focus is on a wide array of typical habitats. LEVEL 2.

Ho: The distribution and abundance of selected bird species do not change from year to year within a season.

3. Sierra Nevada Zone

a) Improve our understanding of habitat relationships in east-side and desert habitats. [Note: Needs to be given emphasis similar to west-side (mixed conifer) habitats.] LEVEL 2/3.

Ho: The occurrence, abundance, productivity, and/or survivorship of bird species in east-side habitats does not vary among seral stages and vegetation types.

b) Describe the occurrence and abundance of NTMBs on South Fork Wildlife Area on the Sequoia NF because it is the largest contiguous riparian woodland forest in the State. LEVEL 3.

Ho: The occurrence, abundance, productivity, and/or survivorship of NTMBs on the South Fork Wildlife Area do not differ from other habitats in the same geographic area.

Ho: The occurrence, abundance, productivity, and/or survivorship of NTMBs on the South Fork Wildlife Area do not differ from other riparian habitats in the same geographic area.

c) Assess the contribution that this zone could make in better understanding the impact of burning on bird species and their populations. Existing burn areas that could be explored: southern half of the Groveland

RD on the Stanislaus NF, Cleveland fire on the Pacific RD of the Eldorado NF, Stormy fire on the Hot Springs/Greenhorn RD of the Sequoia NF. LEVEL 3.

Ho: Burned areas of various ages do not differ from one another or from non-burned areas in the occurrence, abundance, productivity, and/or survivorship of bird species.

4. Klamath Zone

a) Consolidate existing information on NTMBs associated with Douglas-fir old-growth forests that was gathered through the old-growth inventories conducted in 1980-1985. LEVEL 2.

Ho: No NTMB species are strongly associated with Douglas-fir old-growth forests.

b) Investigate the impact of management direction associated with Adaptive Management Areas (AMAs) (see Draft EIS for the Management of the northern spotted owl, 1993) on NTMB species. AMAs cover a substantial portion of the zone. This could also be accomplished by an analysis of existing data. LEVEL 3.

Ho: Management of AMAs does not differentially affect the occurrence, abundance, productivity, and/or survivorship of bird species as compared to areas managed under different objectives. [Note: Many different management regimes exist that can be compared to AMA management. Specific management regimes would have to be isolated and compared to each other and/or some control. Specific null hypotheses will need to be developed for each comparison.]

B. Moderate Priority Monitoring Objectives

Moderate priority monitoring objectives pertain to the effects of management on a landscape scale, such as landscape patterns, fragmentation effects, and connectivity.

1. Region-wide

a) Describe the function of high mountain meadows in providing habitat for NTMB species. [Note: in the Klamath zone, meadows are relatively rare. Meadows of interest in the Klamath Zone include Cedar Grove Ranch (Lower Trinity Rd, Six Rivers NF), Groves Prairie (Lower Trinity RD, Six Rivers NF), Laird Meadow (Orleans RD, Six Rivers NF).] LEVEL 2/3.

Ho: High mountain meadows do not provide habitat conditions for NTMB species that are unique relative to other habitat types available to the species that use them. [Note: Unique would be determined by comparing the occurrence, abundance, productivity, and/or survivorship of bird species and their use of meadows for in meadows and other available habitats.]

b) Determine the effect of landscape condition on bird assemblages at the patch level and bird populations at the landscape level (i.e., the effect of landscape condition on monitoring results at the habitat patch scale). [Note: This objective extends to the impact of management on adjacent non-Forest Service lands on habitat use and population dynamics for species on Forest Service lands.] LEVEL 2/3.

Ho: Landscape condition (as described by any number of parameters, such as habitat abundance, arrangement, and fragmentation) does not affect the occurrence, abundance, productivity, and/or survivorship of bird species. [Note: This requires comparing the relative values for some or all of these population parameters for two or more landscape conditions.]

b) Determine the effects of natural and human-caused fragmentation (e.g., patch size, patch shape, amount and distribution of interior habitat) on bird species in forest and shrub habitats (e.g., giant sequoia, old-growth, chaparral). Specifically, effects include bird species occurrence, abundance, productivity, and survivorship as affected by changes in environmental influences (e.g., parasitism, predation, competition). LEVEL 3.

Ho: The occurrence, abundance, productivity and/or survivorship of a particular species does not change in relation to a particular environmental parameter.

c) Assess where it would be most important to implement cowbird capture programs within the Region. It will be important to monitor the effectiveness of the effort in each location. Capture efforts are already underway in the Sierra and South zones. Capture efforts need to be better integrated with efforts of other agencies. [Note: Perhaps a zone-wide biological evaluation would be desirable and feasible. An example of a coordinated effort among agencies is what is occurring within the South Fork Wildlife Area on the Sequoia NF.] LEVEL3.

Ho: Cowbird capture programs do not change the impact (magnitude or duration) of parasitism on the species they parasitize.

d) Improve our understanding of the effects of human impacts not related to vegetation manipulation (special use permits, recreation, hunting) in high value habitats. In Sierra Nevada Zone, concern exists for foothill oak woodlands a high priority relative to other habitats. Impacts resulting from activities on both Forest Service and adjacent private lands should be included in monitoring efforts. LEVEL 2/3.

Ho: The activity (at some or multiple levels of intensity) does not affect the occurrence, abundance, productivity and/or survivorship of bird species in the vicinity of the activity.

e) Determine the success of habitat improvement projects. LEVEL 2/3.

Ho: The habitat improvement activity did not affect the bird species in terms of its occurrence, abundance, productivity, and/or survivorship.

2. Each zone

a) Investigate the impact that brown-headed cowbirds have on the abundance, occurrence, and productivity of NTMB species within each zone. This will required information on cowbirds as well as the species they parasitize, and should be assessed by zone. Specific information needed on cowbirds would include: distribution and abundance of cowbirds over time; habitat associations; and a better understanding of factors influencing population growth/maintenance (e.g., land use practices, other habitat features such as cows, fences, etc). LEVEL 3.

Ho: The distribution and abundance of brown-headed cowbirds are not affected by specific habitat features.

Ho: Parasitism by cowbirds does not affect the occurrence, abundance, productivity, and/or survivorship of the species they parasitize.

3. South zone

a) Better understand the role of Tajon and Cajon Pass in providing valuable corridors for migration and dispersal for bird species (not restricted to NTMB species). LEVEL 3.

Ho: Tajon and Cajon Passes do not serve as corridors for migration and dispersal to an extent any greater than surrounding areas.

b) Take advantage of the opportunities the South Zone offers in investigating the influence of isolation and fragmentation on population structure and dynamics. Non-desert habitat occurs in "islands" surrounded by either developments or desert habitats. LEVEL 3.

Ho: Isolated habitats do not have unique species composition, feeding habits, demographics, or genetic characteristics.

4. Sierra Nevada Zone

a) Investigate the affect of isolation and fragmentation on the population structure and dynamics of bird species. In certain areas of the zone, habitat occurs in "islands" surrounded by either developments or shrub/desert habitats (in the southern portion of the Sierra Nevada). LEVEL 2/3.

Ho: Isolated habitats do not have unique species composition, feeding habits, demographics, or genetic characteristics.

b) Better understand the role that the Modoc Plateau plays in maintaining important subpopulations (and their associated genetic variability) of species associated with the Sierra Nevada range and/or the Great Basin. In addition, investigate the use and value of the transition area between Klamath Mountains and the Modoc Plateau (occurs on the Klamath NF and Shasta-Trinity NF). It may be important by maintaining species on the edge of their range. [Note: This notion needs to be verified by a review of the literature and existing data.] The Modoc Plateau is a unique geographic region because of the unique combination of habitat types that occur there; it is a crossover area between the Sierra Nevada range, the Cascades, and the Great Basin. It could have important biogeographic implications. LEVEL 2/3.

Ho: The transition habitats between the Modoc Plateau and the Klamath mountains do not have a unique avifauna in terms of species composition, abundance, season of use, productivity, survivorship, or other demographic features.

Ho: The Modoc Plateau does not host genetically unique sub-populations of species on the edge of their range.

Ho: The composition, relative abundance, and productivity of species occupying the Modoc Plateau does not differ from adjacent geographic areas.

5. Klamath

a) Describe the use and value of McCloud Flat (Shasta-Trinity NF) because it has a high density of meadows and is located in close proximity to the Great Basin. Use and value would be described by quantifying the occurrence, abundance, productivity, and/or survivorship of bird species. LEVEL 2/3.

Ho: The occurrence, abundance, productivity, and/or survivorship of bird species using the McCloud Flat during the breeding season (and occurrence and abundance during the non-breeding seasons) does not differ from other habitats in the vicinity.

C. Low Priority Monitoring Objectives

Low priority monitoring objectives pertain to broad-scale monitoring data (National, multi-regional, and some region-wide data) and migration/dispersal data.

1. National and multi-regional

a) Determine how the distribution and abundance of individual bird species change between years within seasons. This could be accomplished using a variety of point count protocols. Efforts referenced here would not be adequate to calculate trends on Forest Service lands, but would contribute to broader efforts. This would pertain primarily to species that do not occupy a large enough geographic area on Forest Service lands to efficiently calculate a precise trend, regardless of the method used (i.e., BBS routes, on-road point counts, off-road point counts). Long term monitoring (i.e., greater than 10 years) is required to meet this objective. LEVEL 1.

Ho: The distribution and abundance of bird species with limited distributions on Forest Service lands species do not change from year to year within a season (breeding or winter).

2. Region-wide

a) Cooperate with USFWS to ensure that the Forest Service is contributing as much as possible to obtaining adequate BBS data on at least a State level. Species of concern (listed in decreasing Calrank order) include Black Swift, Broad-tailed Hummingbird, Gray Flycatcher, Cassin's Kingbird, Ruby-crowned Kingbird, Northern Harrier, and Hooded Oriole. LEVEL 1.

Ho: No change in BBS population trends are occurring within the range of each NTMB species that occurs with California.

b) Determine how the distribution and abundance of individual bird species change between years and within seasons within the Region. Under this objective, the Forest Service could contribute significantly to population trend information for the State because the species has a sizable portion of its range on Forest Service lands. Long-term monitoring (i.e., greater than 10 years in duration) is required to meet this objective. Table 1 lists species that do not have adequate population trend data to date (i.e., BBS data are inadequate). For most species, additional BBS routes will not improve the adequacy of trend data. The survey technique or emphasis area is listed for each species. LEVEL 1.

Ho: The distribution and abundance of bird species with sizable portions of their range on Forest Service lands do not change from year to year with a season.

c) Determine if the distribution and relative abundance of individual bird species varies among zones over time within seasons. The intent is to determine if management schemes or other pressures in various zones are affecting populations differentially. Only a subset of species would be monitored with objective, since meeting this objective will require additional monitoring effort but does not offer any additional information on potential causal factors for observed trends. This objective could be expanded to include intra-zone variation in distribution and relative abundance if the need arose. LEVEL 1.

Ho: The distribution and relative abundance of selected bird species that occur in multiple zones do not change from year to year within a season.

d) Investigate the habitat needs and effects of related management activities for species that are unique to each zone and for which limited information is available (Allen's hummingbird is found primarily in the Klamath zone, with the exception of a small area on the Los Padres), and habitat needs are little known. LEVEL 2/3.

Ho: The habitat associations, abundance, productivity and/or survivorship of the species of interest does not vary between habitats within a season.

3. Each Zone

a) Identify important migration corridors and how various management options affect their utility. LEVEL 3.

Ho: Migratory birds do not use particular features or geographic locations more than others during migration. [Note: Use can be measured in terms of abundance, timing, duration, and species composition.]

b) Investigate the use and value of high mountain meadows for dispersal and migration by bird species. Two years of limited monitoring in Freeman Meadows (Downieville RD, Tahoe NF) suggest that they may serve an important role in providing high quality (i.e., abundant food resources) habitat for dispersing birds prior to and during migration. LEVEL 3.

Ho: Use of high mountain meadows does not differ from the use of other habitat conditions in the same vicinity. [Note: Use can be measured in terms of abundance, timing, duration, species composition, productivity, and survivorship, and can be determined for various seasons.]

Ho: High mountain meadows are not used proportionately greater than other habitats during migration. [Note: Use here should include food resources as well as population parameters.]

4. Sierra Nevada zone

a) Investigate the use and value of the South Fork Wildlife Area as a migration corridor for birds migrating from Sierra Nevada to wintering grounds to

the south. It is located at the intersection of the three major geographic areas (Sierra Nevada, Mohave, and Central Valley). It has a high species richness and may be an important migration corridor. LEVEL 3.

Ho: The South Fork Wildlife Area is not used as a migration corridor either in the spring or fall to any greater extent than surrounding areas.

5. Klamath zone

a) Investigate the use of major river corridors for dispersal and/or migration (e.g., Trinity River on Shasta-Trinity and Six Rivers NFs and the Klamath River on the Klamath and Six Rivers NFs). A monitoring project has been conducted on the Trinity River in two locations (Orleans RD, Six Rivers NF and Big Bar RD, Shasta Trinity NF) for the past 2-3 years. Mist-netting, point counts during spring, summer and fall. In addition, a riparian survey is planned by the Fisheries and Hydrology staffs on the south fork of the Trinity River in FY93. Knopki Creek riparian rehabilitation project (Gasquet RD, Six Rivers NF). LEVEL 3.

Ho: Major rivers do not serve as migration corridors during spring or fall and do not provide habitat that affects the productivity or survivorship of species. [Note: It will be difficult to determine the role of migration corridors in the productivity and survivorship of species.]

b) Improve data on the reproductive success of Peregrine Falcon and Osprey. Monitoring currently is not as comprehensive as desired. LEVEL 3.

Ho: The reproductive success of Peregrine Falcon and Osprey does not vary from year to year and is high enough to contribute to a growing population.

c) Investigate the influence of South Fork Ridge on population structure and movements of NTMBs. The Ridge may serve as a geographic barrier and/or a migratory route (probably raptors, primarily) because it is so long (one of the longest ridges in the State) and prominent. LEVEL 3.

Ho: South Fork Ridge is not used as a migratory pathway by NTMB species, and does not offer a geographically unique migratory pathway.

Ho: Subpopulations of bird species with unique genetic characteristics do not exist on either side of South Fork Ridge. In other words, the ridge does not serve as a barrier or resistance to movement of individuals within the local population.

IV. METHODS AND EXPERIMENTAL DESIGN

A. Monitoring Standards for All Point Counts

Point counts are a component of most monitoring protocols used to monitor bird species, regardless of the monitoring level (as defined here). Standards that apply to all point counts are described below. More detailed information on specific protocols useful at each level of the hierarchy are listed under each level.

1. Count duration. All point counts will be at least 5 minutes in duration. The first 3 minutes of each count will be indicated on data sheets so data can be compared to BBS data. Any counts conducted for longer than 5 minutes will mark the 5 minute point in the count so the first 5 minutes can be extracted from the data.

2. Distance bands. All birds and heard inside and outside a 50 m radius of the counting station will be recorded. The area within 50 m is considered an area where the detectability of species is similar enough to enable the comparison of abundance among species (Ralph et al. in press b). In narrow habitats such as riparian areas, a smaller radius band of 25 m may be added to the 50 m radius band to identify birds occurring within the habitat of interest.

3. Multiple observers. Point counts associated with a monitoring effort will be conducted by multiple observers (one observer per point per morning, but multiple observers among points) (Verner and Milne 1989). The number of observers required will be determined using local or habitat specific information on potential observer bias. Initially, 3 highly skilled observers will be used for data collection in regards to each hypothesis being tested (Verner and Milne 1989). The same 3 observers may be used to gather data to test multiple hypotheses. The assignment of observers to points or transects will attempt to spread the biases of each observer equally across all environmental conditions being monitored. If points are only counted once per season, three observers can survey different stations across all areas so that any biases are compensated for by combining the data across observers. If points are counted more than once per season, then each count should be

conducted by a different observer. Using three observers each year will help to average out individual biases within a year and reduce the likelihood that between-year differences are attributable to the biases of an individual observer.

4. Sample sizes. The number of counting stations required to meet Forest or Regional objectives will be documented in the monitoring plan that accompanies each monitoring effort. Sample size requirements for each effort will be calculated using pilot or first year data to determine sample sizes that will yield the desired level of confidence. If preliminary data are unavailable to estimate minimum sample sizes, local researchers will be consulted to estimate an appropriate sample size. As a last resort, at least the minimum number of counting stations suggested for each level of the hierarchy will be established. As soon as preliminary data becomes available, minimum sample sizes will be calculated. A biometrician will be consulted when calculating minimum sample sizes or when making inferences about minimum sample sizes using local data sources.

5. Permanent stations. All counting stations will be marked permanently and the same stations used each year.

B. Level 1 Monitoring Methods and Trigger Points

Guidelines for implementing level 1 monitoring are outlined below.

1. Establishing counting stations. Counting stations should be located on transects which are distributed randomly across the Forest to obtain a representative sample of habitats and ecotones. Counting stations should be systematically spaced along the transects (see Ralph et al. in press a), and each transect should be short enough to be surveyed in one morning. Transects could be stratified by geographic region (e.g., Districts) to get adequate dispersion of transects across a Forest. Some counting stations could be located along roads to maximize counting efficiency, but the roads should be no larger than tertiary or secondary roads (Hutto et al. in press). Care should be taken when interpreting the data from roadside counts because roads may not access a representative sample of conditions on a Forest (Hutto et al. in prep). A combination of roadside and off-road counting stations is probably the best approach.

2. Sample size requirements. If preliminary or local data are unavailable on a Forest to estimate minimum sample sizes, 200 counting stations per Forest should be considered

the minimum sample size for the first sampling season (Verner and Kie 1988, Thompson and Schwalbach in press). On large or very diverse forests, a larger initial sample size is recommended. After the first sample season, the data must be analyzed to determine the sample size required for precise estimates of changes in presence/absence or abundance at counting stations for the least detectable target species (i.e., species for which monitoring data is desired or needed). After the second year, sample sizes should be reevaluated to determine the minimum sample size needed to detect differences between years. A biometrician should be consulted at each step in the design and analysis process.

3. Count duration and visitation frequency. Counting stations should be visited once during the breeding season for at least a 5 minute count, recording all birds detected around the station. Other objectives may favor longer counts or repeat visits, but the recommended number of visits and count length is limited for level 1 monitoring to increase the number of stations that can be surveyed per unit effort. Increasing the number of counting stations will provide greater statistical power to detect trends (Zar 1984). This protocol best achieves the primary objective of monitoring trends over a large geographic area, although other measures may be compromised (e.g., accurate estimates of the species that occur at a given station).

4. Observers. Each observer should be randomly assigned 1/3 of the transects to be visited.

5. Habitat measurements. At a minimum, vegetation at each counting station should be classified to plant association or sub-type, preferably using an ecological classification system that is consistently applied throughout the Region. Ralph et al. (in press b) describes a releve method that is useful in determining plant associations. Habitat classifications schemes should be identified and described in the Regional monitoring plans. Habitat measurements are not critical in level 1 monitoring because the objective and sample design are not intended to yield information on detailed habitat associations or potential causes of trends.

6. Trigger Points. [to be completed]

C. Level 2 Monitoring Methods and Trigger Points

1. Establishing counting stations. Counting stations should be randomly located throughout as many representative areas as possible for each habitat condition. Blocking techniques should be used to ensure that points are located

throughout the entire area being characterized. Patchiness of habitats should be considered in terms of edge effects on the bird community (i.e., minimum patch sizes may need to be established for sample habitats).

2. Sample size. A number of considerations exist when estimating sample size needs for level 2 monitoring.

a) Describing the species associated with a particular habitat requires that adequate sample sizes are achieved within each habitat for specific species.

b) Minimum sample sizes should be calculated based on preliminary data and desired levels of confidence, whenever possible. A minimum of 100 detections across all sampling points, and detected on at least 30 different sample points should be used as a standard.

c) If preliminary or locally applicable data are unavailable to estimate sample size, then enough sample points should be established such that each species of concern is detected at a minimum of 30 points per habitat condition. Thirty counting stations per replicate sample requires that the 30 stations must be randomly located throughout each habitat condition or treatment. After the first sample season, the data should be analyzed to determine the minimum sample size required to achieve the monitoring objectives. It is highly likely that much larger sample sizes will be needed to meet desired levels of confidence for target species (Fleiss 1981).

d) Counting stations should be established on transects along secondary and tertiary roads or trails when pursuing habitat specific trend information. When management effects or high value habitats are being investigated, a grid array (9-12 stations per grid) may be more appropriate. Stations should be at least 200 meters apart.

3. Count duration and visitation frequency. A number of considerations exist when determining count duration and visitation frequency for level 2 monitoring.

a) Count duration and visitation frequency affect the number of counting stations that can be sampled per unit effort, with the ultimate goal being to provide an accurate estimate of the presence/absence or abundance trends of bird species occurring in specific habitat conditions.

b) Some researchers believe that each counting station should be visited a minimum of 3 times during the breeding season to maximize the probability of detecting a species occurring in a given habitat condition. Monitoring for management effects or the use of high value habitats should adopt a visitation protocol of 3 times during the breeding season. However, other researchers believe that the best method of maximizing the probability of detecting a species occurring in a given habitat condition is to maximize the number of counting stations within each habitat and visit each station only once per breeding season. This approach is most appropriate when information is being gathered over a broad area and the use of specific local areas is not of critical concern.

c) Species accumulation curves should be calculated for each counting station to determine how much time is required to detect the majority of species at each point and if the greatest variability occurs between points or at a point over the counting period.

4. Species. In many cases, a subset of species will need to be chosen on which to base sample size requirements. Species chosen will be assured of adequate sample sizes to describe trends, and should be comprised of species that are perceived to be at risk (e.g., Calrank values from Manley and Davidson 1993).

5. Habitat measurements. First, how one identifies habitats for sampling needs to be decided. To determine what habitats to sample, consider the following: use the WHR classification whenever possible; choose habitats that are common (indicative) within the zone when attempting to collect basic information on species trends in a large geographic area; augment monitoring of common habitats with monitoring in habitats that are impacted by management whenever possible; monitor as broad an array of habitats as possible.

Considerations for habitat measurements in level 2 monitoring are listed below.

a) Habitat characteristics should be quantified at and around each counting station.

b) Each monitoring project should carefully consider the type of habitat information and the level of precision required to address the specific questions being posed.

c) At a minimum, habitat variables such as plant species composition, canopy closure, vegetation structure, slope, aspect, and elevation should be quantified using standardized techniques. The releve method described in Ralph et al. (in press b) describes methods of estimating many of these vegetation characteristics.

d) If monitoring objectives require the vegetation characteristics be quantified precisely, standardized measurement techniques should be used in lieu of visual estimates (James and Shugart 1970, Block et al. 1987b). Standards for habitat measurements and associated protocols should be described in Regional monitoring plans (see section V.B.).

6. Sampling duration. Sampling to establish trends should continue at least 10 years. After 5 years, trends can begin to be calculated, but certainly not all the temporal variability will be reflected in a 5 year long sampling effort.

7. Trigger Points. [to be completed]

D. Level 3 Monitoring Methods and Trigger Points

Monitoring the relative abundance of a species is typically inadequate to address cause and effect relationships of management activities or habitat quality (Van Horne 1983, Hobbs and Hanley 1990). Species abundance does not reflect factors contributing to a species fitness, such as reproductive success or survival of the young once they leave the nest. Southwood (1977) and Van Horne (1983) present convincing arguments for including estimates of reproductive and survival rates in assessments of management effects on species. These data are particularly important for evaluating population viability.

Demographic data consist of two components: (1) survivorship, the probability of survival from birth to age x; and (2) reproduction, the expected number of female offspring for each female of age x per unit time. The monitoring methods described here provide proxies to one or both components of demographic data. Two generalized procedures yield demographic data: constant effort mist netting and nest search and monitoring. Both approaches have inherent advantages and limitations that should be considered before use.

Constant-effort Mist Netting

Constant-effort mist netting (and associated point counts) provides estimates of the following population and demographic parameters: (1) adult population size and post-fledging

productivity from data on the number and proportion of young and adult birds captured; (2) adult population size, adult survivorship, and recruitment into the adult population from capture-recapture data on the adults; and (3) adult population size from intensive point-count data collected in the immediate vicinity of the mist-netting stations.

1. Sample size. A network of at least 40 stations across a multi-state region are required to produce estimates of adult population size and adult survivorship with sufficient precision to provide critical information on the demographic parameters and trends of 10-20 target species. Sufficient precision is defined as a coefficient of variation (CV) of 20% for the mid-year annual estimate or a CV of approximately 5% for the mean annual estimate in a 10-year study. To characterize high value habitats, at least 16 net arrays (10 nets each) should be established in clumps of 2 or 3. To characterize management effects, fewer mist net arrays are required - a minimum of 4 arrays per management condition.

2. Sample frequency and duration. Nets should be sampled twice every 10 day period Netting should continue for at least 5 years to derive productivity or survivorship trends.

3. Species. A subset of species should be targeted for accomplishing minimum sample sizes. The first couple of years data should be analyzed to determine what species are of interest and if capture rates are adequate to answer questions of interest.

Nest Search

Nest search and monitoring offer an alternative method of obtaining demographic data. They provide information on productivity via nest success, in addition to information on habitat associations. The strengths of nest search and monitoring are that: (1) productivity data can be directly associated with habitat conditions; and (2) factors affecting productivity, such as predation and brood parasitism, can be quantified.

1. Sample size. When characterizing species associated with high value habitats, 16 10-hectare plots should be sampled. A minimum of 20 nests per species need to be located over the duration of the sampling effort. However if trends are desired, then 20 nests must be located per species per time interval (could be 1-3 years in duration, depending on monitoring objectives and data needs). If other information needs are met, pooling across years and plots may be feasible to meet sample size requirements. However, pooling across plots increases variability of the

data within each habitat, making trends within and among habitats more difficult to discern. When monitoring management effects, it may be more difficult to obtain an adequate sample size for species of interest.

2. Sample duration. Productivity and survivorship trends will require at least 5 years of continuous data collection to be calculated.

3. Species. Because nest searches are time intensive, a subset of species should be identified and the majority of effort will be spent obtaining an adequate sample size for key species versus looking for any nest in an area regardless of the species (in which case there may not be enough nests of any species for analysis).

4. Trigger points. [to be completed]

V. HABITAT MONITORING

A. Habitat Importance

Resources for habitat conservation should be directed toward habitats that are both important to NTMBs and at risk (already rare or facing threats). In general, habitats that are of high importance to NTMBs but are currently abundant and secure, or habitats at risk but of low importance to NTMBs should be a lower priority for conservation. Setting habitat conservation priorities should entail three steps: (1) evaluating the importance of different habitats to NTMBs; (2) evaluating the current status, trends, and threats to habitats; and (3) combining habitat importance and habitat risk to determine priority habitats and appropriate conservation efforts. the results of the habitat importance analysis (step 1) conducted by Manley and Davidson (1993) is used here to help identify habitats for monitoring.

Manley and Davidson (1993) used the Wildlife Habitat Relationships (WHR) habitat classification system to describe habitats within the State. It identifies 48 different habitat types within California (Mayer and Laudenslayer 1988) (Table 2). These habitat types were ranked in order of importance to NTMBs. Five importance ranks were derived for each of the WHR habitat types based on the following parameters: (1) NTMB species richness; (2) total California risk rank; (3) number of high Calrank species; (4) number of NTMBs with declining population trends; and (5) number of NTMB specialists. A more detailed description of the methods used for the habitat importance ranking can be found in Manley and Davidson (1993).

Valley-foothill riparian habitat was the top ranked habitat, followed by Montane Riparian, Valley Foothill Hardwood, Valley Foothill Hardwood-Conifer, Desert Riparian, Annual Grassland, and Wet Meadow (Table 2). A cursory assessment of how much each habitat type covers the state, as well as how much is found within the three zones was also conducted (Table 2). Twenty-one of the 48 habitat types analyzed had 50 percent or greater of their total acreage on National Forest lands. In addition, of the top 10 ranked habitat types, 50 percent or greater of Montane Riparian and Mixed Conifer acreage occurs on National Forest Lands.

With regard to unique habitats within zones, the Klamath zone is the only one that contains Douglas-fir (roughly 50% of the total acreage of this habitat type within the State). The South zone is the only zone in which Desert Succulent Scrub and Palm Oasis occur. The percentage of the total acreage of the state in these habitat types is low, so every acre has greater significance. These two types are found within the Santa Rosa Wilderness of the San Bernardino NF. Several habitat types are found in only two of the three monitoring zones established here, but the majority of habitat types occur within all the zones. habitat types.

B. Objectives for Habitat Monitoring (in order of priority)

1. Riparian habitats and oak woodlands are highly valuable habitats, and qualitative assessments indicate that they are highly impacted within the State. The status of these habitats needs to monitored, and efforts made to conserve them. In addition, the distinction needs to be made between different types of riparian habitat with zones and the Region.

2. Monitor the quantity and quality of habitats that are rare and/or are highly valuable (e.g., high mountain meadows, habitats being impacted to an unknown degree by grazing, pack stations) to NTMBs and that primarily occur on Forest Service lands.

3. Track the fate of all vegetation types at the series level (at a minimum) within the Region.

[These need to be expanded to reflect information in the Table and develop associated hypotheses and trigger points (if possible).]

VI. MONITORING PRIORITIES

A. Habitat or Species Monitoring

A monitoring program needs to have a balance of monitoring among species, habitats, geographic locations, and the types of data. The risk analysis addressed species that should probably receive greater attention regarding a variety of types of information (e.g., population trend, more detailed information needs). Striking a balance is easy to say and difficult to meaningfully achieve. General tenets can be set, but the specifics will depend to a large degree on the expertise and interest available in the Region and where it is located. As a broad statement, the first year should focus on basic monitoring needs (level 1 and some level 2 monitoring activities) over a broad geographic area, in conjunction with a full implementation (i.e., a combination of level 1-3 monitoring activities) in one (or more if feasible) geographic areas to determine if the plan as a whole outlines a worthwhile goal.

Objectives were roughly prioritized in an earlier section. The rationale and information used to prioritize objectives and activities is discussed below.

B. Level 1 Monitoring Priorities

Table 3 displays the information for each zone which is necessary for setting monitoring priorities for species or groups of species. All 139 species of NTMB are listed, along with variables and their scores useful for determining the relative risk (Calrank) assessed for each species, the level of BBS population trend data, and information on the extent of each species' breeding range in California. In addition, Table 3 indicates the level of research available for each species, and the portrays the level of habitat specialization for each species.

For Level 1 monitoring it is important to obtain adequate BBS data. Priorities for monitoring within this level should be based upon the individual species' Calrank and the need for acquiring BBS data so that population trends can be determined for that species. For example, Bell's Vireo has a high CALRANK and poor BBS data. This species should be prioritized for level 1 monitoring over, for example, the American Goldfinch, which has a lower Calrank and adequate BBS data.

Information on NTMB species within each zone requiring adequate BBS population trend data and the type of monitoring needed to improve trend data (Table 1) can be used to prioritize monitoring surveys within zones by reviewing the number of species potentially detected by each survey method (Table 4) and the associated Calranks of those species (Table 1).

C. Level 2 Monitoring Priorities

For Level 2 monitoring, priorities should be determined utilizing information on habitat requirements and coinciding rates of habitat decline. Some of this information is displayed in Table 3 under the variable 'Habitat specialization'. A species with a high habitat specialization score, such as the willow flycatcher, could have a higher priority for monitoring than a species with a similar Calrank but a low habitat specialization score, such as the black swift. This indicates that the willow flycatcher utilizes specific habitat types that may be in decline or are threatened, whereas the black swift has a low specialization for habitat and may use 9 to 12 different habitat types. The fact that both species have poor BBS data would have to be addressed through Level 1 monitoring efforts.

In addition, Table 3 presents two other variables that are useful in determining priorities for level 2 monitoring. For each species, information is given on the percentage of that species range that is within California. The proportion of the species range in California can affect monitoring priorities in a variety of ways. For example, a species which has a very high proportion of its breeding range in California and is declining only in California should be a high priority for whatever type of monitoring data are lacking. Similarly, a species with a low proportion of its range in California and declining Nationally but not in California might also be a priority for gathering appropriate monitoring data to better understand the importance of the California population in maintaining the species and what environmental factors affect the persistence of the species in the State.

The final variable useful for setting level 2 priorities is the level of research uncertainty for threats on each species' breeding grounds. This variable is a gross indication of information needs. Specific information needs should be identified in the objectives listed under each monitoring level.

D. Level 3 Monitoring Priorities

For Level 3 monitoring, BBS data can be used to determine monitoring priorities. For example, a species such as the olive-sided flycatcher has a high Calrank, and the BBS trend shows a decline in North America and California. This species would be prioritized over a species such as the rufous hummingbird, which has a comparable Calrank, but BBS data indicate a declining trend only in North America.

VII. DATA APPLICATIONS

[Monitoring data can be used to provide data for assessing habitat condition - useful for impact analysis.]

[Indicator species -use of NTMBs]

VIII. DATA CENTER SERVICES

[copied from R10 - needs to be tailored more to R5]

A. Breeding Bird Survey

Data collection on BBS routes will follow the protocol established by the US Fish and Wildlife Service. Standardized BBS forms will be used for data collection and will be submitted to the Patuxent Wildlife Research Center in Laurel, Maryland.

The BBS database is maintained at the Patuxent Wildlife Research Center in Laurel, Maryland. Summaries of the data from individual routes or from entire states are available upon request. In addition to the raw data, route totals undergo route-regression analysis in order to estimate the population trends for each species. Population trends are routinely developed for each species observed on BBS routes in every state/province and physiographic strata for the following intervals: 1966 through the present, the most recent 10-year interval (currently 1980-1989), and the most recent 2-year period. These population trend data are also available upon request, but can be obtained through an electronic bulletin board system (phone: 301-498-0402; this system is currently running at 2400 baud, 8 bit parity, no stops, and full duplex).

B. Constant-effort Mist-netting Stations

Data collection at constant-effort mist-netting stations will follow the protocol established by the Institute for Bird Populations. Standardized forms will be used for data collection and will be submitted to the Institute for Bird Populations in Inverness, California.

The Institute for Bird Populations is in an ideal situation to provide for management, analysis and dissemination of data from all of the MAPS stations operated in a Region. The Institute for Bird Populations has an agreement with the US Fish and Wildlife Service to analyze at least the capture/recapture component of the MAPS data in conjunction with personnel at the Patuxent Wildlife Research Center. As a result, the population trend and demographic data collected on National Forest lands are analyzed both separately and in combination with MAPS data from other

federal, state and private lands. Furthermore, the california MAPS data could then become part of a national data base accessible to all research and management personnel throughout the country. The Institute for Bird Populations also prepares and distributes annual reports of both regional and national scope. Reports to Region 5 may be tailored to discuss the results obtained from those stations located only on National Forest lands, as well as the results obtained by placing these data in the context of the larger picture of region-wide or continent-wide MAPS data.

The Institute of Bird Populations provides computer data entry and analysis of all banding and point count data, provides copies of both the original (raw) and computer-readable data to the Region and to each participating National Forest/Area, and provides an annual report that discusses the results obtained only from the stations located on National Forest lands in the Region, as well as the results obtained by placing these data in the context of the larger picture of continent-wide MAPS data.

C. Point Counts

Data recording forms and processes presented by Ralph et al. (in press a, in press b) will be used for all point surveys conducted in Region 5. A Regional Neotropical Monitoring Data Center has been established by the California Working Group of the .Partners In Flight (PIF) Program and is administered by the Redwood Sciences Laboratory in Arcata, California. The data center will: (a) serve as a repository for all monitoring data; (b) provide standardized field and data entry forms and procedures; (c) conduct data analysis and interpretation of data collected within the State; and (d) generate regional, State-wide, and special reports to meet the needs of participating agencies and non-governmental groups.

Data files will be accepted by the Data Center in the ASCII format. When data entry is complete, contact the Center via DG and they will FAX the forms needed to send the data files. Include the administrative area's (e.g., District) name and address, a phone number and a FAX number in the initial DG message. When the forms are received, complete the Cooperator Information Form and mail with the data diskettes to:

Regional Neotropical Migrant Data Center
1700 Bayview Drive
Arcata, California 95521

A Location Form will be included in package of forms sent. Fill in as much information as possible about each study site (i.e., point count station) and send this form in with the data. If all of the information is not readily available, send what is and

send in the additional information when it is available. A copy of a map, such as a topographical map, with the location of the stations(s) marked is also needed.

If the data has not been entered, data entry programs are available from the Data Center. The programs and instructions may be requested by DG and the forms will be FAXed to you. Fill in the Cooperator Information Form and send it to the Data Center. Be sure to indicate the diskette size needed for your computer and check the types of data you will be entering. The programs require an IBM compatible computer equipped with a hard drive.

IX. IMPLEMENTATION SCHEDULE

[needs to be completed]

X. PLAN UPDATES

[needs to be completed]

XII. LITERATURE CITED [unedited from standards - needs to have some citations removed and added]

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XII. FIGURES AND TABLES

Figure 1. Map of the monitoring zone boundaries. [to be completed]

Table 4. Summary of the types of surveys required to obtain population trend data for neotropical migratory species that do not currently have adequate Breeding Bird Survey data. The number of species surveyed by each technique are summarized by geographic zone.

Type of Survey	Southern	Sierra	Klamath
Riparian Surveys	8	7	8
Diurnal Raptor Surveys	9	9	9
Winter Surveys	8	8	8
Nocturnal Surveys	4	3	3
BBS routes in state	0	1	0
BBS routes in phys. region	7	7	5
Unknown	5	5	4
None	9	8	8

Table 1. Neotropical migratory birds with inadequate BBS population trend data and the type of monitoring needed to improve trend data. Species are listed in order of descending California risk rank (Calrank) as a means of prioritizing monitoring efforts.

Common name	Calrank	Type of monitoring	Abbrev.
BELL'S VIREO	6.03	riparian surveys	R
ELF OWL	5.78	none	-
PEREGRINE FALCON	5.47	diurnal raptor surveys	D
RUFOUS HUMMINGBIRD	5.45	none	-
WILLOW FLYCATCHER	5.25	unknown	U
BLACK SWIFT	5.23	BBS routes in phys. region	B
YELLOW-BILLED CUCKOO	5.12	riparian surveys	R
GRASSHOPPER SPARROW	4.98	none	-
VIRGINIA'S WARBLER	4.84	none	-
WHIP-POOR-WILL	4.84	nocturnal surveys	N
FERRUGINOUS HAWK	4.77	winter surveys	W
NORTHERN GOSHAWK	4.70	diurnal raptor surveys	D
VAUX'S SWIFT	4.64	diurnal raptor surveys	D
BROAD-TAILED HUMMINGBIRD	4.48	BBS routes in State	B
BENDIRE'S THRASHER	4.43	none	-
LUCY'S WARBLER	4.34	none	-
GRAY VIREO	4.27	none	-
SWAINSON'S HAWK	4.18	diurnal raptor surveys	D
CALLIOPE HUMMINGBIRD	4.02	riparian surveys	R
BROWN-CRESTED FLYCATCHER	4.02	none	-
RED-SHOULDERED HAWK	3.90	BBS in physiographic region	B
SUMMER TANAGER	3.87	riparian surveys	R
GRAY FLYCATCHER	3.87	BBS in physiographic region	B
WILLIAMSON'S SAPSUCKER	3.85	none	-
EASTERN KINGBIRD	3.85	none	-
WESTERN FLYCATCHER	3.80	unknown	U
CASSIN'S KINGBIRD	3.79	BBS in physiographic region	B
GOLDEN EAGLE	3.78	diurnal raptor surveys	D
VERMILION FLYCATCHER	3.78	none	-
COMMON POORWILL	3.77	nocturnal surveys	N
BRONZED COWBIRD	3.77	none	-
FLAMMULATED OWL	3.76	nocturnal surveys	N
TOWNSEND'S SOLITAIRE	3.74	none	-
RUBY-CROWNED KINGLET	3.64	BBS in phy. reg. and wntr	B,W
PURPLE MARTIN	3.63	diurnal raptor surveys	D
BLACK-CHINNED HUMMINGBIRD	3.62	riparian surveys	R
LINCOLN'S SPARROW	3.62	riparian surveys	R
RED-NAPED SAPSUCKER	3.62	unknown	U
OSPREY	3.56	riparian surveys	R
SHORT-EARED OWL	3.52	diurnal raptor and winter	D,W
WHITE-WINGED DOVE	3.52	none	-

Table 1 cont.

Common name	Calrank	Type of Monitoring	Abbrev.
NORTHERN HARRIER	3.52	BBS in phys. region	B
RED-BREASTED SAPSUCKER	3.49	unknown	U
PRAIRIE FALCON	3.47	diurnal raptor surveys	D
LONG-EARED OWL	3.44	noct. and winter survey	N,W
SHARP-SHINNED HAWK	3.44	diurnal raptor surveys	D
MERLIN	3.44	winter surveys	W
COOPER'S HAWK	3.41	diurnal raptor surveys	D
HOODED ORIOLE	3.39	BBS in phys. region	B
LEWIS' WOODPECKER	3.35	none	-
BLUE GROSBEAK	3.33	unknown	U
BLUE-GRAY GNATCATCHER	3.33	none	-
BELTED KINGFISHER	3.23	riparian surveys	R
TOWNSEND'S WARBLER	3.20	winter surveys	W
CEDAR WAXWING	2.71	winter surveys	W
MOUNTAIN BLUEBIRD	2.51	winter surveys	W

Table 2. Ranking of habitats in California based on their importance to neotropical mirgrant birds (NTMB). Values for five measures of importance are listed, along with their rank orders and an overall habitat rank (Habrank) based on the average rank order of three variables. Habitats are listed in order of decreasing importance to NTMBs.

#	Habitat Name	RTMBRICH	RSUMCALR	RHICALRA	RTMBDECL	RTMBSPEC	HABRANK	% OF STATE	% ON FS LAND	GEOGRAPHIC ZONE		
										SOUTH	SIERRA	KLAMATH
1	VALLEY-FOOTHILL RIPARIAN	1.0	1.0	1.0	3.0	2.0	2.0			X	X	X
2	MONTANE RIPARIAN	4.0	4.0	4.0	6.0	3.0	4.3			X	X	X
3	VALLEY-FOOTHILL HARDWOOD	2.0	2.0	2.5	1.5	18.0	7.3			X	X	X
4	VALLEY-FOOTHILL HW-CONIFER	3.0	3.0	2.5	1.5	18.0	7.3			X	X	X
5	DESERT RIPARIAN	6.0	6.0	7.5	15.5	1.0	8.0			X	X	
6	ANNUAL GRASS	9.5	9.0	5.0	4.0	18.0	9.0			X	X	X
7	WET MEADOW	12.0	12.0	11.5	8.5	8.5	9.5			X	X	X
8	PINE-JUNIPER	15.0	15.0	11.5	15.5	4.0	10.3			X	X	
9	PASTURE	13.0	13.0	14.5	10.0	8.5	11.0			X	X	X
10	MIXED CONIFER	8.0	8.0	11.5	15.5	8.5	11.8			X	X	X
11	MONTANE HARDWOOD	7.0	7.0	9.0	8.5	18.0	11.8			X	X	X
12	ORCHARD-VINEYARD	22.0	19.0	16.5	15.5	5.0	12.3			X	X	X
13	PERENNIAL GRASS	11.0	11.0	7.5	5.0	30.0	14.1			X		X
14	MONTANE HARDWOOD-CONIFER	5.0	5.0	6.0	7.0	30.0	14.3			X	X	X
15	PONDEROSA PINE	9.5	10.0	14.5	11.5	18.0	14.6			X	X	X
16	DOUGLAS-FIR	14.0	14.0	11.5	15.5	18.0	15.0					X
17	REDWOOD	24.0	23.0	20.5	15.5	18.0	18.0			X		X
18	SAGEBRUSH	28.5	27.0	24.5	24.5	8.5	19.1				X	X
19	MONTANE CHAPARRAL	18.5	18.0	20.5	24.5	18.0	21.0			X	X	X
20	CROPLAND	20.0	22.0	29.0	24.5	18.0	23.8					
21	JUNIPER	28.5	30.0	29.0	35.0	8.5	24.1				X	X
22	DESERT SCRUB	34.5	34.0	34.0	30.0	8.5	24.1					
23	CLOSED-CONE PINE-CYPRESS	32.0	29.0	20.5	11.5	41.5	24.5			X	X	X
24	LODGEPOLE PINE	22.0	20.0	20.5	24.5	30.0	25.0			X	X	X
25	DESERT SUCCULENT SHRUB	39.0	38.0	29.0	30.0	18.0	25.6			X		
26	BARREN	30.0	28.0	16.5	20.0	41.5	26.0					
27	MIXED CHAPARRAL	17.0	16.0	20.5	20.0	41.5	27.3			X	X	X
28	COASTAL SCRUB	26.5	26.0	20.5	20.0	41.5	27.3			X		X
29	BITTERBRUSH	31.0	32.0	29.0	24.5	30.0	27.8				X	X
30	CHAMISE-REDSHANK CHAPARRAL	25.0	25.0	24.5	30.0	30.0	28.1			X	X	X
31	DESERT WASH	34.5	35.0	34.0	24.5	30.0	29.5			X	X	
32	JOSHUA TREE	39.0	39.0	37.0	35.0	18.0	30.0					
33	JEFFREY PINE	16.0	17.0	29.0	35.0	30.0	31.3			X	X	X
34	FRESH EMERGENT WETLAND	26.5	31.0	40.0	39.5	18.0	32.5			X	X	X
35	RED FIR	22.0	24.0	29.0	39.5	30.0	32.8				X	X
36	EASTSIDE PINE	18.5	21.0	29.0	35.0	41.5	35.1				X	X
37	RIVERINE	34.5	33.0	34.0	30.0	41.5	35.1			X	X	X
38	ASPEN	39.0	40.0	46.0	44.5	18.0	36.1				X	X
39	LACUSTRINE	39.0	37.0	37.0	30.0	41.5	36.1			X	X	X
40	SALINE EMERGENT WETLAND	34.5	36.0	43.0	39.5	30.0	37.5			X		X
41	ALKALAI SCRUB	44.0	44.0	40.0	35.0	41.5	38.8			X	X	
42	LOW SAGEBRUSH	42.0	42.0	43.0	44.5	30.0	39.1				X	X
43	SUBALPINE CONIFER	43.0	43.0	37.0	39.5	41.5	39.3			X	X	X
44	PALM OASIS	39.0	41.0	46.0	44.5	30.0	40.1			X		
45	ALPINE DWARF SHRUB	47.0	47.0	40.0	44.5	41.5	42.0			X	X	X
46	MARINE	45.5	45.0	43.0	44.5	41.5	43.0			X		X
47	ESTUARINE	45.5	46.0	46.0	44.5	41.5	44.0			X		X

Table 2 cont.

Where:
NtmbRich = Number of NTMB species associated with habitat.
SUMCALRA = Total Calrank value of NTMB species associated with habitat.
HICALRAN = Number of high Calrank species associated with habitat.
NTMBDECL = Number of NTMB with declining population trends associated with habitat.
NTMBSPEC = Number of NTMB habitat specialists associated with habitat.
RTBRICH = Rank order of NTMBRich (number of NTMB species associated with habitat).
RSUMCALR = Rank order of SUMCALRA (total Calrank value of NTMB associated with habitat).
RHICALRA = Rank order of HICALRAN (number of high Calrank species associated with habitat).
RTMBDECL = Rank order of NTMBDECL (number of NTMB with declining population trends associated with habitat).
RTMBSPEC = Rank order of NTMBSPEC (number of NTMB habitat specialists associated with habitat).
HABRANK = Habitat importance index = average of rank order of HICALRNK, NTMBDECL and NTMBSPEC.
NOTE: the lower the value of the index, the more important the habitat.

Table 3. A sample of variables and their scores useful for setting monitoring priorities for neotropical migratory birds in California. Species are listed in descending order according to their California Risk Rank values (Calrank).

		LEVEL 1	LEVEL 2 AND 3				GEOGRAPHIC ZONES		
COMMON NAME	CALRANK	Poor BBS	Declining BBS trend[1]	% of range in Calif[2]	Research uncert[3]	Habitat SPEC[4]	South	Sierra Nevada	Klamath
BLACK-CHINNED SPARROW	6.21		N,C	3	5	3	X	X	X
OLIVE-SIDED FLYCATCHER	6.21		N,C	2	5	3	X	X	X
BELL'S VIREO	6.03	X	N	2	3	5	X		
ELF OWL	5.78	X		1	4	5			
LOGGERHEAD SHRIKE	5.51		N,C	2	4	1	X	X	X
AMERICAN GOLDFINCH	5.51		N,C	2	3	5	X	X	X
WESTERN BLUEBIRD	5.48		N,C	2	3	1	X	X	X
PEREGRINE FALCON	5.47	X		2	1	1	X	X	X
RUFOUS HUMMINGBIRD	5.45	X	N	2	4	1			X
BREWER'S SPARROW	5.40		N	2	4	4	X	X	X
WHITE-THROATED SWIFT	5.30		N,C	2	3	1	X	X	X
WILLOW FLYCATCHER	5.25	X		2	3	5	X	X	X
BAND-TAILED PIGEON	5.25		N	3	3	2	X	X	X
BLACK SWIFT	5.23	X		3	4	2	X	X	X
WHITE-CROWNED SPARROW	5.17		N,C	2	1	2	X	X	X
AMERICAN KESTREL	5.16		C	2	2	1	X	X	X
YELLOW-BILLED CUCKOO	5.12	X	N	2	3	4	X	X	
PINE SISKIN	5.10		C	2	3	3	X	X	X
HORNED LARK	5.08		C	2	1	2	X	X	X
WESTERN MEADOWLARK	5.04		C	2	3	1	X	X	X
BARN SWALLOW	5.03		C	2	1	1	X	X	X
CHIPPING SPARROW	5.02		C	2	4	1	X	X	X
KILLDEER	5.02		C	2	2	2	X	X	X
GRASSHOPPER SPARROW	4.98	X	N	2	4	5	X	X	X
LARK SPARROW	4.86		N,C	2	3	1	X	X	X
VIRGINIA'S WARBLER	4.84	X		2	5	5		X	
WHIP-POOR-WILL	4.84	X		1	4	4	X		
FERRUGINOUS HAWK	4.77	X		1	3	2	X	X	X
NORTHERN GOSHAWK	4.70	X		1	4	2	X	X	X
BANK SWALLOW	4.67		C	1	4	3		X	X
VAUX'S SWIFT	4.64	X		2	4	5		X	X
BLACK-THROATED SPARROW	4.51		N,C	2	4	3	X	X	X
SWAINSON'S THRUSH	4.49		C	2	4	5	X	X	X
BROAD-TAILED HUMMINGBIRD	4.48	X		2	3	4		X	
BENDIRE'S THRASHER	4.43	X		2	5	5	X		
LUCY'S WARBLER	4.34	X		2	5	4			
WESTERN WOOD-PEWEE	4.30		C	2	4	1	X	X	X
GRAY VIREO	4.27	X		2	4	4	X		X
NORTHERN ORIOLE	4.24		C	2	3	2	X	X	
SWAINSON'S HAWK	4.18	X		2	3	3	X	X	X
DARK-EYED JUNCO	4.17		N,C	2	2	1	X	X	X
COSTA'S HUMMINGBIRD	4.14			4	3	2	X	X	
BREWER'S BLACKBIRD	4.11		C	2	5	1	X	X	X
SAY'S PHOEBE	4.08		C	2	3	1	X	X	X
NORTHERN ROUGH-WINGED SWALLOW	4.06		C	2	3	1	X	X	X
MOURNING DOVE	4.04		C	2	1	1	X	X	X
AMERICAN ROBIN	4.03		C	2	1	1	X	X	X
CALLIOPE HUMMINGBIRD	4.02	X		3	4	1	X	X	X
BROWN-CRESTED FLYCATCHER	4.02	X		1	4	5			
RUFOUS-SIDED TOWHEE	3.98		N	2	4	1	X	X	X
RED-SHOULDERED HAWK	3.90	X		2	3	3	X	X	X
ALLEN'S HUMMINGBIRD	3.88			5	4	3	X		X
SUMMER TANAGER	3.87	X		2	4	5	X	X	
GRAY FLYCATCHER	3.87	X		2	5	4	X	X	X

Table 3 cont.

COMMON NAME	CALRANK	LEVEL 1	LEVEL 2 AND 3				GEOGRAPHIC ZONES		
		Poor BBS	Declining BBS trend[1]	% of range in Calif[2]	Research uncert[3]	Habitat SPEC[4]	South	Sierra Nevada	Klamath
LAWRENCE'S GOLDFINCH	3.87			5	4	2	X	X	X
WILLIAMSON'S SAPSUCKER	3.85	X		3	3	4	X	X	X
EASTERN KINGBIRD	3.85	X		1	3	5		X	X
WESTERN FLYCATCHER	3.80	X		3	3	2	X	X	X
DUSKY FLYCATCHER	3.80			2	4	2	X	X	X
CASSIN'S KINGBIRD	3.79	X	N	2	4	2	X	X	
GOLDEN EAGLE	3.78	X		2	2	1	X	X	X
VERMILION FLYCATCHER	3.78	X		1	4	5			
COMMON POORWILL	3.77	X		2	4	1	X	X	X
BRONZED COWBIRD	3.77	X		1	2	5			
FLAMMULATED OWL	3.76	X		2	4	1	X	X	X
WILSON'S WARBLER	3.74			2	4	4	X	X	X
TOWNSEND'S SOLITAIRE	3.74	X		2	4	4	X	X	X
RUBY-CROWNED KINGLET	3.64	X	N	2	2	3	X	X	X
HERMIT WARBLER	3.63			5	5	3	X	X	X
PURPLE MARTIN	3.63	X		2	3	3	X	X	X
RED-NAPED SAPSUCKER	3.62	X		1	3	3	X	X	
BLACK-CHINNED HUMMINGBIRD	3.62	X		3	3	3	X	X	X
LINCOLN'S SPARROW	3.62	X		2	3	5	X	X	X
MARSH WREN	3.61			2	4	5	X	X	X
OSPREY	3.56	X		1	3	2	X	X	X
MACGILLIVRAY'S WARBLER	3.54			2	5	4	X	X	X
WESTERN KINGBIRD	3.53			2	2	3	X	X	X
SAGE THRASHER	3.53			2	3	4		X	X
SHORT-EARED OWL	3.52	X		2	4	3	X	X	X
WHITE-WINGED DOVE	3.52	X		2	2	3	X		
NORTHERN HARRIER	3.52	X		2	3	3	X	X	X
YELLOW WARBLER	3.52			2	3	3	X	X	X
ORANGE-CROWNED WARBLER	3.52			2	4	3	X	X	X
RED-TAILED HAWK	3.49			2	2	1	X	X	X
ANNA'S HUMMINGBIRD	3.49			5	3	1	X	X	X
RED-BREASTED SAPSUCKER	3.49	X		3	3	1	X	X	X
PRAIRIE FALCON	3.47	X		2	3	1	X	X	X
ROCK WREN	3.47		N	2	2	2	X	X	X
YELLOW-BREASTED CHAT	3.47			2	3	5	X	X	X
LESSER GOLDFINCH	3.47		N	2	4	1	X	X	X
LONG-EARED OWL	3.44	X		2	3	2	X	X	X
SHARP-SHINNED HAWK	3.44	X		1	3	2	X	X	X
MERLIN	3.44	X		1	4	1	X	X	X
COOPER'S HAWK	3.41	X		2	3	1	X	X	X
RED-WINGED BLACKBIRD	3.41		N	2	1	2	X	X	X
LAZULI BUNTING	3.40			2	4	3	X	X	X
SCOTT'S ORIOLE	3.40			2	4	4	X	X	
WESTERN TANAGER	3.39			2	4	2	X	X	X
VIOLET-GREEN SWALLOW	3.39			2	3	2	X	X	X
HOODED ORIOLE	3.39	X		2	3	3	X	X	
LEWIS' WOODPECKER	3.35	X		3	5	2	X	X	X
GREEN-TAILED TOWHEE	3.35			2	3	2	X	X	X
BLUE GROSBEAK	3.33	X		2	3	5	X	X	
BLACK-HEADED GROSBEAK	3.33			2	4	1	X	X	X
BLUE-GRAY GNATCATCHER	3.33	X		2	4	3	X	X	X
SONG SPARROW	3.32			2	3	1	X	X	X
SAVANNAH SPARROW	3.25			2	4	3	X	X	X
WARBLING VIREO	3.23			2	4	3	X	X	X

Table 3 cont.

COMMON NAME	CALRANK	LEVEL 1	LEVEL 2 AND 3				GEOGRAPHIC ZONES		
		Poor BBS	Declining BBS trend[1]	% of range in Calif[2]	Research uncert[3]	Habitat SPEC[4]	South	Sierra Nevada	Klamath
BELTED KINGFISHER	3.23	X		2	2	3	X	X	X
BROWN CREEPER	3.23			2	3	2	X	X	X
PURPLE FINCH	3.23			2	4	2	X	X	X
CLIFF SWALLOW	3.20			2	4	3	X	X	X
TOWNSEND'S WARBLER	3.20	X		1	5	1	X		X
GOLDEN-CROWNED KINGLET	3.18			2	4	2	X	X	X
CASSIN'S FINCH	3.12			2	2	3	X	X	X
BROWN-HEADED COWBIRD	3.10			2	1	1	X	X	X
NORTHERN FLICKER	3.09			2	1	1	X	X	X
YELLOW-HEADED BLACKBIRD	2.95			2	3	5	X	X	X
TURKEY VULTURE	2.91			2	4	1	X	X	X
HAMMOND'S FLYCATCHER	2.81			2	5	3		X	X
NORTHERN MOCKINGBIRD	2.75		N	2	1	2	X	X	X
CEDAR WAXWING	2.71	X		2	3	5	X	X	X
BLACK-THROATED GRAY WARBLER	2.65			3	5	3	X	X	X
NASHVILLE WARBLER	2.65			2	4	3	X	X	X
COMMON NIGHTHAWK	2.54			2	4	1	X	X	X
MOUNTAIN BLUEBIRD	2.51	X		2	3	3	X	X	X
BURROWING OWL	2.45			2	4	1	X	X	X
LESSER NIGHTHAWK	2.45			2	4	1	X	X	
SAGE SPARROW	2.45			3	4	2	X	X	X
ASH-THROATED FLYCATCHER	2.39			2	4	2	X	X	X
YELLOW-RUMPED WARBLER	2.34			2	2	2	X	X	X
PHAINOPEPLA	2.26			2	3	3	X	X	X
TREE SWALLOW	2.23			2	3	2	X	X	X
FOX SPARROW	2.21			2	3	1	X	X	X
HOUSE WREN	2.12			2	1	2	X	X	X
VESPER SPARROW	2.11			1	4	3	X	X	X
COMMON YELLOWTHROAT	1.61			2	4	3	X	X	X
SOLITARY VIREO	1.45			2	4	1	X	X	X
HERMIT THRUSH	1.42			2	4	2	X	X	X

[1]Declining 26 year BBS trend:
N,C = declining both in North America and California
C = declining in California but not in North America
N = declining in North America but not in California

[2]Percent of breeding range in California (from Carter and Barker in prep):
1 = Very low proportion, less than 1% to total breeding range
2 = Low proportion, 1-10% of total breeding range
3 = Moderate proportion, 11-25% of total breeding range
4 = High proportion, 26-50% of total breeding range
5 = Very high proportion, over 50% of total breeding range

[3]Research uncertainty for threats on the breeding grounds (from Carter and Barker in prep):
1 = Many references or a definitive work exists on the species
2 =
3 =
4 =
5 = Uncertain, few references, only basic life history information exists

[4]Habitat specialization (see Appendix B for description of variable):
1 = Very low specialization, over 13 habitats used
2 = Low specialization, 9-12 habitats used
3 = Moderate specialization, 5-8 habitats used
4 = High specialization, 3-4 habitats used
5 = Very high specialization, 1-2 habitats used